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ing usually of rolling movements towards the operated side. The results in all cases are without exception. Further, removal of the semicircular canals, and filling the vestibulum with melted paraffin, cause no disturbance of locomotion or equilibrium. Since neither removal of the semicircular canals nor complete exclusion of the vestibulum, closing it with paraffin, cause any disturbance, but only mechanical stimulation of the latter gives rise to the rotatory movements, Steiner attempts to explain the disturbance as due to direct lesion of the cephalic end of the medulla oblongata, at the point of emergence of the auditory nerves. This view is very hypothetical, and the conclusion that the condition of things in the shark holds for the higher vertebrates, also has too slender a foundation to be valuable.

This lengthy notice does not touch on many smaller observations which the author has recorded, nor does it point out what is new and what old in the observations cited. So important, however, is the fundamental idea that development of function is as real a thing as development of form, and so often is the idea disregarded in biological speculation, that it has appeared worth while to give a full statement of this work of Steiner, which so well illustrates the possibilities of this line of investigation.

Histologische Studien an der menschlichen Netzhaut. PROF. KUHNT in Jena. Jenaische Zeitschrift für Naturwissenschaft, xxiv, 1. p. 177.

The investigation of Prof. Kuhnt (of which this is a preliminary notice) had two objects,—first, to determine what ones of the histological constituents belong to the tissues of support and connection, and what to the nervous elements; and second, to trace the connections of the nervous elements from the layer of fibres through to the rods and cones. He finds, contrary to the opinion of Borysiekiewicz, that the radial fibres have one nucleus only, and that the internal limiting membrane belongs to the vitreous body. He has no theory to offer as to the function of the reticular layers, but thinks that they cannot play the part of insulators, because for this purpose they would be most needed in the fovea, where they are thinnest. [May they not act as veils, to diminish the amount of light which reaches the rods and cones, and so to facilitate the concentration of the attention upon the sensations of the fovea?] In regard to the nervous parts of the retina, he was so successful as to obtain, after many failures, three good preparations showing a plain connection between ganglia of the optic nerve (ganglionic layer) and of the retina (inner nuclear layer),—which has not been accomplished before. The connecting fibre sprang, in each case, from the body of the ganglion, and not from any of the large processes, and it had only inconsiderable varicosities. Of the fibres which come from a cell of the inner nuclear layer, it is the middle one of an umbel of fibres which joins onto a cell of the outer nuclear layer. It was determined from a large number of observations, that every ganglion of the outer nuclear layer is connected with a single cone, and with a larger or smaller number of rods, according to its more peripheral or more central position in the retina. Less frequently, it was made out that a single pigment cell encloses the cone and the group of rods which communicate with a single nuclear cell. [That an arrangement of this sort must prevail, had been affirmed before by Emil duBois-Reymond, from a consideration of the numerical relations of the fibres and of the rods and cones. A cone, with a group of rods around it, all attached to one ganglion of the outer layer, ought henceforth to be called a *cone-system.*] Under the action of a given coloring reagent, not only did the color of the processes of the ganglia vary with their thickness and with their distance from the cell, but the ganglia themselves were sometimes colored throughout, sometimes only near the nucleus, only in the

nucleus, or only in the nucleolus. Whether this was owing to actual chemical differences, or to the particular condition of excitation at the moment of death of the ganglion, could not be made out. This last suggestion is a very interesting one, and invites to further investigation. In regard to one important point, we cannot help thinking that the author is very obscure. He decides against any possibility of a specific energy in the separate visual elements from the fact, as we understand him,—there are, unfortunately, no plates—that a single cell of the inner nuclear layer is connected with several cells of the ganglionic layer. In the first place, this connection would seem to be a physical impossibility, from the fact that the number of cells in the inner nuclear layer is much greater than in the ganglionic layer. In the second place, absolutely nothing is said about the multiplicity of the connection between the inner and the outer nuclear layer. In the third place, is it quite certain that several different fibres may not preserve their continuity on going through a single ganglionic cell? C. L. F.

On the morphology of the compound eyes of Arthropods. S. WATASE. Studies from the Biological Laboratory, Johns Hopkins University, Baltimore. Vol. iv, No. 6, 1889. Plates XXIX—XXXV.

The author has made both a careful and extensive study of his subject. The paper opens with "a consideration of the *ommatidium* as the morphological unit of the compound eye in arthropods, just as each little circle of rods with a cone in its centre may be considered as the morphological unit of the 'mosaic layer' (Henle) of the human retina." The *ommatidium* in *Serolis*, which is first described, presents three strata of cells. The most superficial is designated *corneagen*, the next the *vitrella*, and the deepest the *retinula*. This last alone is sensory. Each of these cells secretes chitin or a chitinous substance on what is morphologically its outer surface. The cells are, therefore, homologous with the ectodermal cells covering the surface of the body, and the *ommatidium*, with its various specializations, is morphologically a pit in the ectoderm. With *Serolis* as a type, the *ommatidia* of *Talorchestia*, *Combarus*, *Homarus* and *Calinectes*, and a number of others, are found to agree in all essentials. The compound eye of *Limulus* is next described, and the very primitive conditions found in this ancient form are in harmony with the previous observations. The pits in *Limulus* are much less complete than in the other forms described, and the dioptric apparatus less perfect. In discussing the compounding of an eye from these *ommatidia*, the anatomical point is made that the nervous prolongations of the *retinulæ* first form an intricate plexus, and then take their course to the optic ganglia. From the physiological side, it is pointed out that all vision is punctate, whether it be the vertebrate or invertebrate eye which is the organ; and therefore, in considering the vision of a given arthropod, its fineness is measured to some extent by the size of the individual *ommatidia*, whereas the range depends on the number of these units, and the manner in which they are distributed, exposure of *ommatidia* over a spherical surface giving an eye with the widest range. In an appendix, it is stated that the eye-spots in *Asteridæ* agree in their essential structure with those of the arthropods. The paper contains much more of interest, which is, however, not in place here, but which helps to make it a most valuable contribution to our knowledge of the sense-organs.

On the descending degenerations which follow the lesions of the Gyrus marginalis and the Gyrus fornicatus in Monkeys. E. P. FRANCE. With an introduction by Professor Schäfer, F. R. S. Phil. Trans., vol. 180, (1889) B. pp. 331-354. 3 plates.

The brains used in this investigation were from animals that had been employed for physiological experiments by Prof. Schäfer, in conjunction